OCEANOGRAPHICAL OBSERVATIONS OFF ASAMUSHI DURING 1953

BULLETIN OF THE MARINE BIOLOGICAL STATION OF ASAMUSHI,
VOL. VII, NOS, 2, 3, and 4. 1955

OCEANOGRAPHICAL OBSERVATIONS OFF ASAMUSHI DURING 1953*)

BUNRYÛ TSUBATA

津 幡 文 隆

Marine Biological Station of Asamushi, Aomori Prefecture, Japan

(With 4 Figures and 1 Table)

INTRODUCTION

This article is a report on the oceanographical observations carried out at a definite station as the routine work during January to December, 1953.

The method of observation was the same as that in the investigations of preceding years. As shown in Table 1, nineteen series of observations were made in this year.

The writer wishes to express his hearty gratitude to Prof. Dr. S. Nomura, Director of the Marine Biological Station of Asamushi, Tôhoku University, for constant guidance in the course of the work.

RESULTS

1) *Water Temperature*

The conditions of water temperature in 1953 are shown in Fig. 1.

The minimum water temperature was observed during from the middle of February to the middle of March. At the surface, the cold water below 6°C occurred in the same season and the value of 5.39°C which was the lowest temperature in 1953, was observed on February 17. Thereafter the water temperature gradually rose in each layer and approached the maximum. The maximum temperature appeared at the surface early in August, that at the 10 m depth in the middle of August, and that at the 30 m depth in the middle of September in this year. It was noticed that the maximum at the surface appeared early in August, while it usually occurrs in the middle or in late August. The curve of temperature seems rather not to differ much in October, November and December compared with the preceding year.

Considering the annual change of vertical distribution of water temperature in 1953, the direct stratification, which seems to be rather uncommon in the winter

* Contributions from the Marine Biological Station of Asamushi, No. 216.

season, was observed on January 5, After this the inverse stratification occurred twice a year during from late January to the middle of March, and from early September to the middle of December. Meanwhile, the period of direct stratification was between the middle of May and the middle of August. Taking

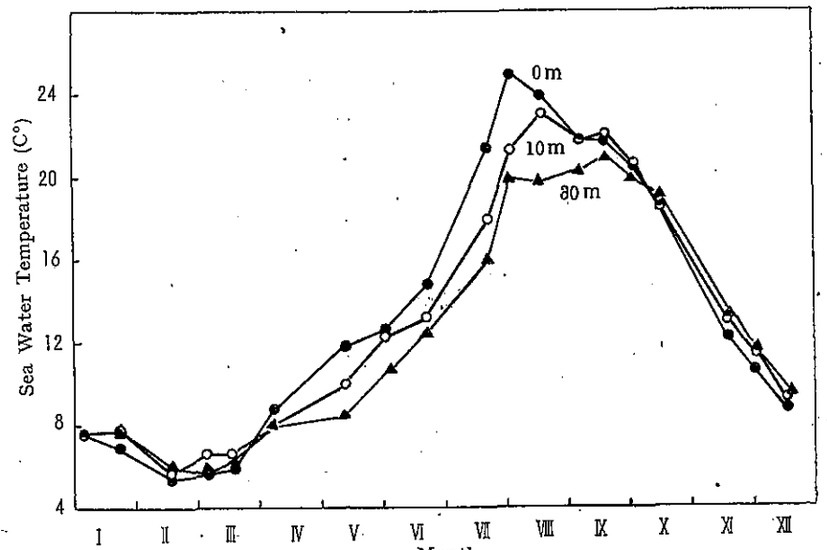

Fig. 1. Annual change of Sea water temperature at different depths during 1953.

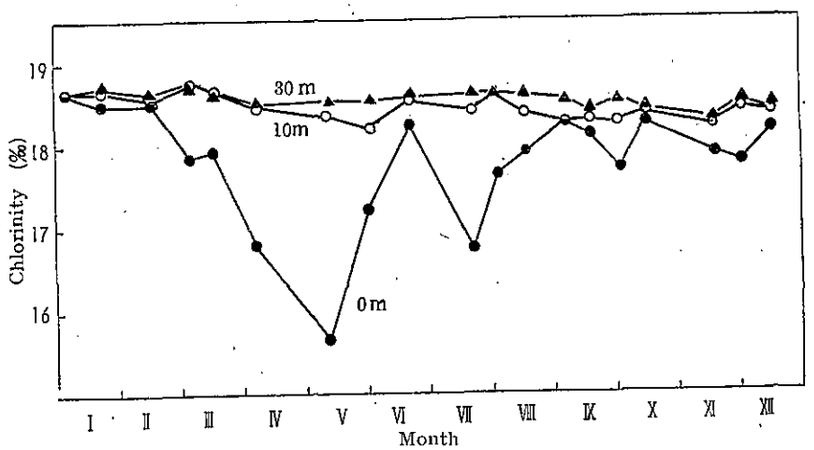

Fig. 2. Annual change of chlorinity at different depths during 1953.

Table 1

Oceanographical conditions observed at definite Station off Asamushi during 1953.

No. of Observations	Date	Water Temperature (°C)					Chlorinity (‰)					Oxy-	
		0	5	10	20	30	0	5	10	20	30	0	5
1	Jan. –5	7.64	7.64	7.61	7.61	7.59	18.65	18.64	18.64	18.64	18.64	6.53	6.48
2	Jan. –22	6.91	7.55	7.79	7.94	7.92	18.50	18.62	18.67	18.69	18.69	6.70	6.61
3	Feb. –17	5.39	5.52	5.69	6.05	6.05	18.50	18.52	18.54	18.62	18.63	7.19	7.05
4	Mar. –5	5.60	6.47	6.62	6.66	5.83	17.86	18.64	18.74	18.74	18.76	7.30	7.20
5	Mar. –17	5.91	6.62	6.62	6.61	6.57	17.94	18.64	18.65	18.66	18.67	7.22	7.17
6	Apr. –7	8.69	8.28	8.00	8.02	8.12	16.80	18.20	18.46	18.49	18.49	6.93	6.94
7	May –11	11.82	10.28	9.94	8.89	8.41	15.67	18.28	18.36	18.51	18.55	6.71	6.71
8	June –1	12.64	12.41	12.32	11.94	10.46	17.23	18.20	18.21	18.48	18.54	6.30	6.28
9	June –21	14.76	13.75	13.24	12.66	12.52	18.24	18.54	18.54	18.61	18.61	6.04	6.32
10	July –21	21.29	18.80	17.87	16.86	15.94	16.76	18.40	18.41	18.41	18.61	5.97	5.73
11	Aug. –2	24.91	22.29	21.27	20.88	19.88	17.66	18.51	18.58	18.58	18.62	5.17	5.50
12	Aug. –17	23.93	22.99	23.01	21.08	19.76	17.91	18.39	18.38	18.50	18.61		
13	Sept. –6	21.76	21.80	21.79	21.70	20.22	18.25	18.25	18.26	18.25	18.55	5.25	5.26
14	Sept. –18	21.72	21.82	22.00	21.86	20.98	18.13	18.17	18.28	18.31	18.41	5.63	5.08
15	Oct. –2	20.42	20.47	20.64	20.69	19.49	17.69	17.69	18.27	18.30	18.52	5.50	5.29
16	Oct. –15	18.54	18.82	18.49	18.88	18.98	18.26	18.32	18.37	18.41	18.42	5.39	5.32
17	Nov. –18	12.20	12.45	13.05	13.35	13.38	17.87	18.06	18.22	18.29	18.29	5.96	5.85
18	Dec. –1	10.59	11.27	11.40	11.55	11.60	17.77	18.32	18.40	18.43	18.47	6.19	6.03
19	Dec. –16	8.80	8.82	9.31	9.43	9.43	18.16	18.18	18.38	18.42	18.42	6.46	6.42

gen (cc/L)			Saturation of O_2, %					pH					Colour of Water	Transparency
10	20	30	0	5	10	20	30	0	5	10	20	30		
6.50	6.52	6.60	96.3	95.5	95.8	96.0	96.9	8.4	8.4	8.4	8.4	8.4	4	12
6.72	6.60	6.39	97.1	97.3	99.5	98.0	94.5	8.4	8.4	8.4	8.4	8.4	5	10
7.03	6.91	6.92	100.2	99.0	99.0	98.5	98.4	/	/	/	/	/	5	9
7.19	7.12	7.13	102.0	103.4	103.4	102.6	103.0	/	/	/	/	/	5	/
7.20	7.12	7.13	101.4	103.2	103.6	102.2	102.2	/	/	/	/	/	5	8
6.97	6.98	6.96	101.4	102.6	103.0	103.0	103.0	8.4	8.4	8.4	8.4	8.4	5	10
6.80	6.63	5.60	104.0	104.1	104.4	100.0	83.9	/	/	/	/	/	6	6.5
6.70	6.56	6.30	106.0	106.0	107.4	105.0	98.0	/	/	/	/	/	4	13
6.42	6.50	6.42	101.6	105.0	105.8	105.0	104.4	/	/	/	/	/	4	11
5.90	5.77	5.08	109.6	103.0	104.8	100.4	88.0	8.4	8.4	8.4	8.3	8.3	5	9.5
5.48	5.42	5.10	102.8	107.8	103.8	102.0	96.0	8.4	8.4	8.4	8.4	8.4	4	9
/	/	/	/	/	/	/	/	8.4	8.4	8.4	8.4	8.4	5	8
5.41	5.36	5.06	99.8	100.0	103.0	101.4	94.0	8.4	8.4	8.4	8.4	8.4	5	9
5.40	5.05	4.66	100.4	96.5	102.6	96.2	87.2	8.4	8.4	8.4	8.4	8.4	4	10
5.13	5.00	4.39	101.0	98.0	96.0	93.6	80.5	8.4	8.4	8.4	8.4	8.4	6	7
5.31	5.22	5.28	97.0	96.3	96.0	94.6	95.5	8.4	8.3	8.4	8.4	8.5	6	10
5.76	5.25	5.30	95.0	94.0	93.9	85.9	87.0	8.4	8.5	8.5	8.5	8.4	4	6
5.98	6.00	5.98	95.8	95.2	94.3	95.2	95.2	8.5	8.5	8.5	8.5	8.5	4	11
6.40	6.29	6.38	97.0	97.0	97.0	95.5	97.0	8.4	8.4	8.4	8.5	8.5	4	12

this point into considepation, 1953 seems rather to be a normal year.

2) *Chlorinity*

The seasonal changes of chlorinity in 1953 are shown in Fig. 2.

The quantity of chlorinity at 10 m and 30 m depths was less variable throughout the year, flactuatirg between 18.22 ‰ and 18.67 ‰ at 10 m depth, between 18.29 ‰ and 18.69 ‰ at 30 m depth. The chlorinity of surface showed almost the same value (18.65 ‰) with that of 10 m and 30 m depth at January 5. Since the early March, it gradualy decreased and attained the lowest value of this year in the middle of May.

From 1950 untill the present study, the value below 16.00 ‰ observed, is tabulated as follows.

Year	Date		Chlorinity
1950	Apr.	16	14.66 ‰
	May	2	15.85
1951	Apr.	6	15.94
1952	Apr.	8	14.59
1953	May	5	14.67
	May	11	15.67

As was seen in the above table, the lowest value of chlorinity has been observed during from April to May in each year. It is thought that the low chlorinity of surface layer in the spring season, must be caused by the thaw water, as reported in this series. Thereafter the chlorinity of surface mounted to 18.25 ‰ on June 21, increased gradually, but there was again a low value on July 21, showing 16.76 ‰. The decrease of chlorinity can be accounted for by the increased inflow of inland water into Mutsu Bay, for the period from June to July has been the rainy season in every year. After this season to December, the chlorinity of surface increased, and no such decrease as in May and July was observed in this year.

As regards the annual change of vertical distribution, it was seen that the chlorinity showed the lowest value at the surface in every month, and increased with the depth.

3) *Dissolved Oxygen*

The curves of annual change of dissolved oxygen in 1953, (Fig. 3) did not differ much from that in 1952.

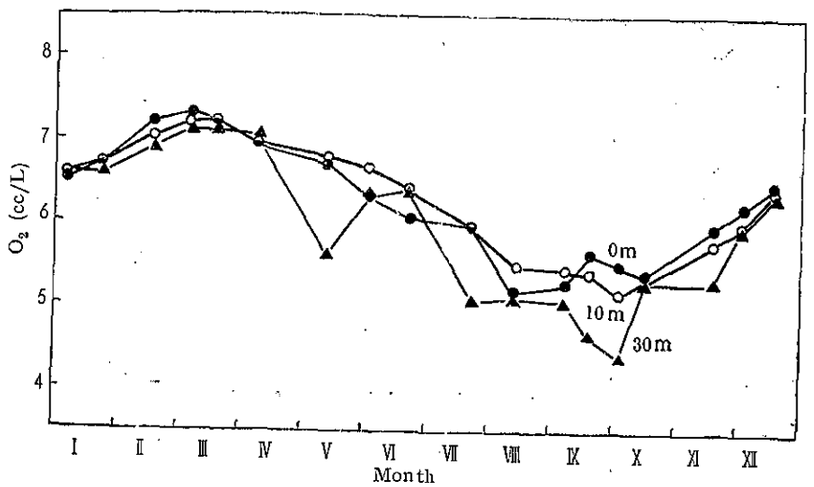

Fig. 3. Annual change of the O_2 content of sea water at different depths during 1953.

In 1953, the maximum oxygen content in each layer was observed in March, but the minimum values occurred at the surface in August, at 5 m depth in September, and below 10 m depth in October.

Referring to the data in 1952, the extreme values have been as follows:—

	Highest value			*Lowest value*		
Year	O_2, cc/l	Depth	Date	O_2, cc/l	Depth	Date
1952	7.36	O & 5 m	Mar. 18	4.26	30 m	Sept. 15
1953	7.30	O m	Mar. 5	4.39	30 m	Oct. 2

From the above table, it is noted that the highest value appeared in the spring season, showing about 7.3 cc/l at the surface layer, and that the minimum value in the autumn season, showing about 4.3 cc/l at the bottom layer.

As regards the vertical distribution, oxygen content in each month showed the highest value in the surface throughout the year and the lowest value in 30 m depth, except some observations. But it can be seen from Fig. 3 that oxygen content at 10 m depth was rather larther than that at the surface in April, May, June, August and September, owing to the photosynthesis of phyto-plankton.

The seasonal change of the percentage saturation in this year (Fig. 4) indicated that it varied between 109.6% and 96% at the surface, betwee 107.4% and 93.9% at 10 m depth, and between 104.4% and 80.5% at 30 m depth, and that at 30 m

depth it was more variable than in other layers, as was seen in the preceding years.

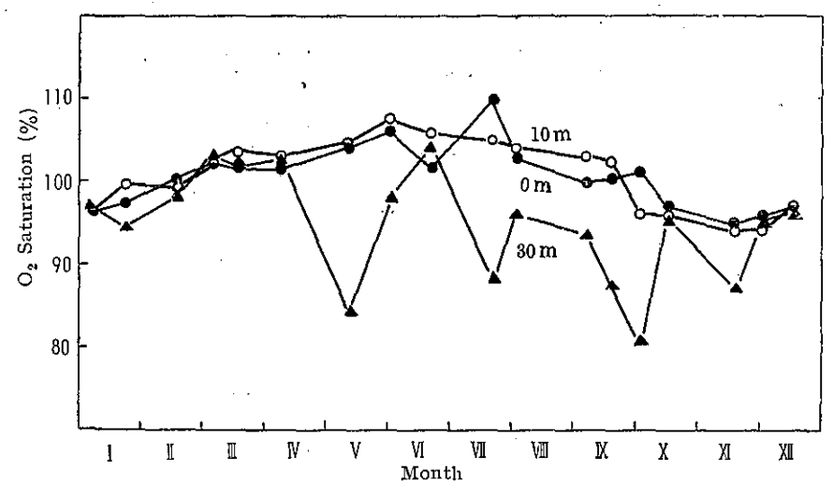

Fig. 4. Annual change of saturation of O_2 at different depths during 1953.

The percentage saturation exceeding 100% was observed during the period from March to September, and the highest value was 109.6% at the surface in early July and 107.4% at 10 m depth in early June. The lowest value was 80.5% at 30 m depth in early October.

SUMMARY

1. This article is a report on the oceanographical observations carried out as the routine work at the definite station during January to December, 1953.

2. In the annual change of water temperature, it iwas noticed that the maximum at the surface appeared in early August in this year.

3. The seasonal change of chlorinity in this year indicated that the chlorinity in 10 m and 30 m layers was less variable, while at the surface the remarkable decrease appeared in May and July.

4. The annual change of dissolved oxygen showed that the maximum value appeared in the spring season, the minimum in the autumn season.

LITERATURE

1) KOKUBO, S. and T. TAMURA 1938 Observations on the plankton and hydrographic conditions of Aomori Bay during the period 1933-1935. Rec. Ocean. Works. Japan. **10** (1) : 1–15.

2) OKITSU, O., T. TOKUI and B. TSUBATA 1954 Oceanographical observations off Asamushi during 1952. Bull. Mar. Biol. Stat. Asamushi, **7** (1) : 21–25.

3) TSUBATA, B. 1953 Report on the temperature and chlorinity of the waters off Asamushi during 1951. Bull. Mar. Biol. Stat. Asamushi, **6** (1–4) : 1–5.